

NOISE ASSESSMENT

**Borrego 1 Solar Project
MUP 3300-10-026
Environmental Review Number 10-050-01
APN 140-290-12**

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GLOSSARY OF TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 μ Pa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by $20 \log (L/L_{ref})$.

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. L_{eq} is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (L_{dn}): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB “Penalty” for night time noise. Typically L_{dn} ’s are measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the development of the proposed Borrego 1 Solar Project located on a single parcel totaling approximately 308 gross acres. The Project is located in the unincorporated community of Borrego Springs in eastern portion of San Diego County, CA.

Based on the empirical data, the manufactures specifications, and the distances to the property lines, the unshielded cumulative noise levels from the proposed transformers/inverters and the site Substation were found to be below the most restrictive nighttime property line (zoned S-92) standard of 45 dBA at all property lines. No impacts are anticipated and no mitigation is required.

The measured Corona Affect noise levels associated with the 69 kV gen-tie line were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission lines associated with the proposed Project.

At a distance as close as 165 feet, the point source noise attenuation from the grading activities and the nearest property line is -10.4 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 74.9 dBA at the property line. During the installation of the PV panels, a noise level of 74.9 dBA would result at a distance of 275 feet. The installation equipment is anticipated to average a distance of more than 300 feet from the nearest property line. Given this and the spatial separation of the equipment over the large site area, the noise levels of the grading and PV panel installation are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having a legal dwelling unit. Some of the properties adjacent the Project site do not have a legal dwelling unit are therefore are exempt from Section 36.409. Therefore no impacts are anticipated from the grading or PV panel installation operations at any property line and no mitigation or additional analysis is warranted.

1.0 INTRODUCTION

This noise study was completed to determine the noise impacts associated with the development of the proposed Borrego 1 Solar Project. The Project is located at 33° 17' 31" N and 116° 21' 12" W, at the southwest corner of Henderson Canyon Road and Borrego Valley Road in the Borrego Springs Community located within the County of San Diego. The general location of the Project is shown on the Vicinity Map, Figure 1-A.

1.1 Project Description

The Borrego 1 Solar Project is a proposed photovoltaic (PV) solar generating facility. The Project Site is approximately 308 acres of private land that has previously been used for agriculture.

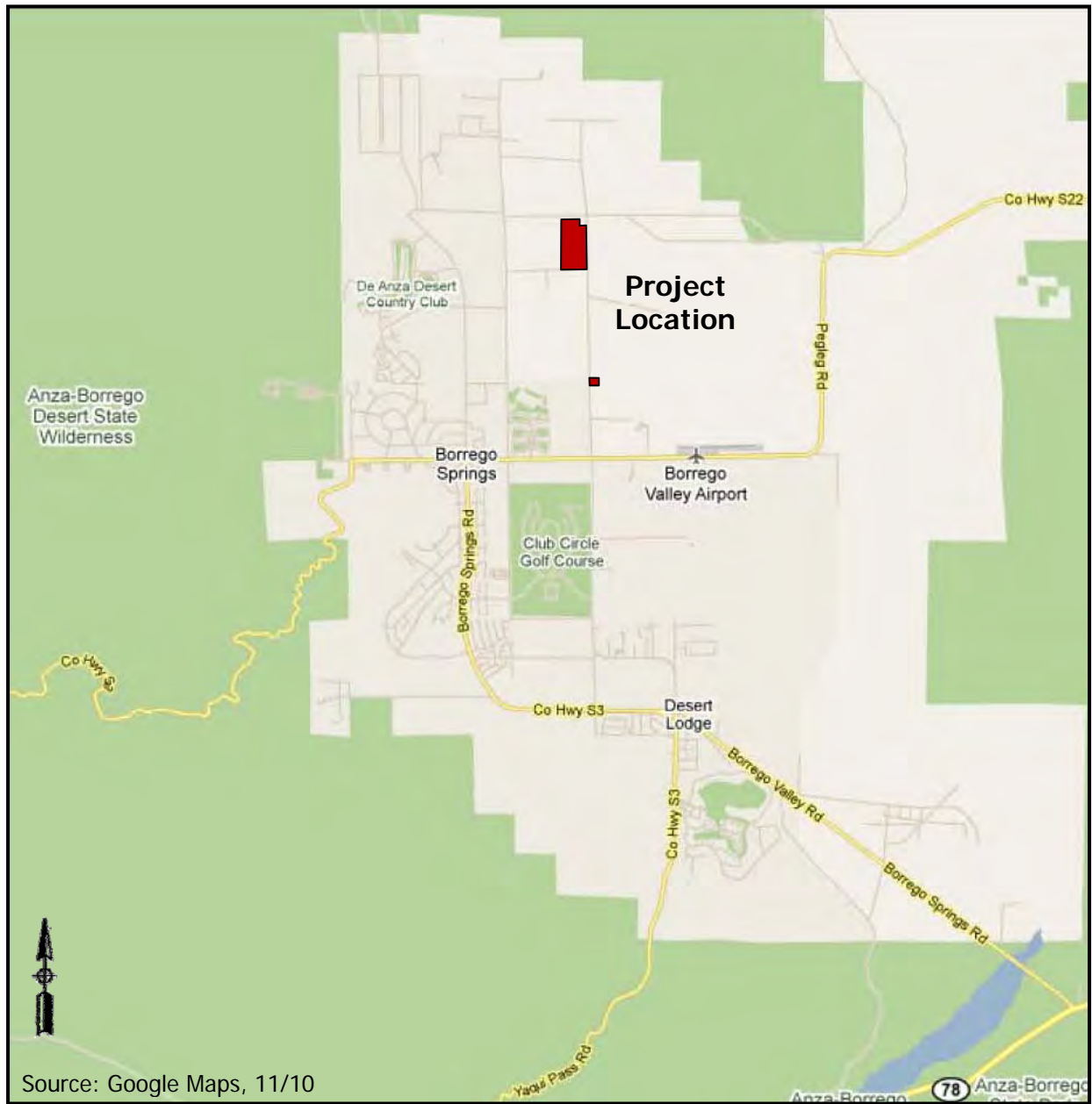
The Project's PV panels will be mounted either on fixed tilt supports or single-axis trackers. If built using fixed tilt mounting, the Project will be built in two phases – the first phase being 26 MWac (32 MWdc) and the second being about 9 MWac (11 MWdc). If built using single-axis trackers, the Project will be built out in one phase of approximately 26 MWac (31 MWdc).

The main project access will be located at the southeast corner of the site on Borrego Valley Road with a secondary access on Henderson Canyon Road. No sewer service or potable water is required as the facility would be unmanned. Water would be used for dust suppression during construction and the Project would use approximately two acre-feet of water annually during operation for cleaning the solar panels. This water will be provided from an existing well on a nearby property and trucked to the site when needed.

The site would be grubbed to remove existing vegetation and almost no grading would be necessary as it is already level. The soil surface will be smoothed and compacted to prepare the site for installation of the solar panels. The construction period for the 26 MW phase (using either mounting system) is expected to be a 4 to 6 month timeframe.

The only off-site improvement associated with the Project is a 69kV generation-tie (gen-tie) transmission line from the site to SDG&E's existing Borrego Substation. The proposed gen-tie line is approximately one mile in length and would be located within the disturbed right-of-way on the west side of Borrego Valley Road. The interconnection at the existing substation would occur within its current footprint. The general project layout, existing SDG&E substation location and proposed Gen-Tie line route can be seen in Figure 1-B. The site plans for the two potential configurations used for this analysis are shown on Figure 1-C and Figure 1-D below.

Figure 1-A: Project Vicinity Map



Henderson Canyon Road

PROJECT SITE

Proposed On-Site Substation

Proposed Gen-Tie Route

Borrego Valley Road

Existing Substation Expansion

N.A.P. 140-290-11

N.A.P. 140-290-12

N.A.P. 140-290-04

N.A.P. 140-290-05

N.A.P. 140-290-08

N.A.P. 141-030-52

N.A.P. 141-030-53

N.A.P. 141-030-26

N.A.P. 141-030-27

N.A.P. 141-030-22

N.A.P. 141-030-28

N.A.P. 141-210-XX

N.A.P. 141-210-XX

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[illegible]

1.2 Environmental Settings & Existing Conditions

a) Settings & Locations

The Project would consist of a PV solar generation project on a single parcel of land, with additional lands affected to allow for transport of the power generated to the existing Borrego Substation. The County Assessor Parcel Number (APN) affected by the proposed Project for the main facilities include 141-230-26 (approximately 308 acres). The main project access will be located at the eastern edge of the site on Borrego Valley Road with a secondary access on Henderson Canyon Road. The zoning for the Project parcel and all surrounding land uses is General Rural (S-92).

b) Existing Noise Conditions

The Project is located adjacent to Borrego Valley Road and Henderson Canyon Road and previously used for agriculture. Both Borrego Valley Road and Henderson Canyon Road are described as Light Collector (2.2E) roadways in the County of San Diego's Circulation Element. Existing noise occurs mainly from vehicular traffic traveling on the adjacent roadways, agricultural equipment and air traffic from the nearby airport.

1.3 Methodology and Equipment

a) Noise Measuring Methodology and Procedures

To determine the ambient noise environment and to assess potential noise impacts, measurements of the Corona Affect were taken along an existing SDGE 69 kV transmission line located in the area. This was done to determine the local conditions and to establish a baseline for the Corona Affect of the proposed gen-tie transmission line. The noise measurements were recorded on December 4, 2009 by Ldn Consulting, Inc. between approximately 9:30 a.m. and 10:00 a.m. in dry, calm and clear conditions. The sound levels for the proposed on-site equipment were taken from the manufacture's specifications.

Noise measurements were taken using a Larson-Davis Model LxT Type 1 precision sound level meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The LxT was set to record in the low range of -10 to 110 dBA. The sound level meter and microphone were mounted on a tripod, five feet above the ground and equipped with a windscreen during all measurements. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200.

The noise measurement location was determined based on site access and low ambient conditions to capture only the potential transmission line noise levels. The 69 kV transmission line

measurements were taken mid-span between two power poles along an existing San Diego Gas & Electric (SDGE) easement. The noise measurement location and relationship to the proposed Project location is provided graphically in Figure 1-E, denoted by the SDGE Easement marker.

Figure 1-E: Corona Affect Noise Measurement Location



b) Noise Calculations and Factors

Noise is defined as unwanted or annoying sound which interferes with or disrupts normal activities. Exposure to high noise levels has been demonstrated to cause hearing loss. The individual human response to environmental noise is based on the sensitivity of that individual, the type of noise that occurs and when the noise occurs.

Sound is measured on a logarithmic scale consisting of sound pressure levels known as a

decibel (dB). The sounds heard by humans typically do not consist of a single frequency but of a broadband of frequencies having different sound pressure levels. The method for evaluating all the frequencies of the sound is to apply an A-weighting to reflect how the human ear responds to the different sound levels at different frequencies. The A-weighted sound level adequately describes the instantaneous noise whereas the equivalent sound level depicted as L_{eq} represents a steady sound level containing the same total acoustical energy as the actual fluctuating sound level over a given time interval.

The Community Noise Equivalent Level (CNEL) is the 24 hour A-weighted average for sound, with corrections for evening and nighttime hours. The corrections require an addition of 5 decibels to sound levels in the evening hours between 7 p.m. and 10 p.m. and an addition of 10 decibels to sound levels at nighttime hours between 10 p.m. and 7 a.m. These additions are made to account for the increased sensitivity during the evening and nighttime hours when sound appears louder.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiant in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions. Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. On the other hand, fixed/point sources radiate outward uniformly as it travels away from the source. Their sound levels attenuate or drop off at a rate of 6 dBA for each doubling of distance.

The most effective noise reduction methods consist of controlling the noise at the source, blocking the noise transmission with barriers or relocating the receiver. Any or all of these methods could be required to reduce noise levels to an acceptable level.

2.0 OPERATIONAL ACTIVITIES

2.1 Guidelines for the Determination of Significance

Section 36.404 of the County of San Diego noise ordinance provides performance standards and noise control guidelines for determining and mitigating non-transportation, or stationary, noise source impacts to adjacent properties. The purpose of the noise ordinance is to protect, create and maintain an environment free from noise that may jeopardize the health or welfare, or degrade the quality of life.

The County Noise Ordinance states that it shall be unlawful for any person to cause or allow the creation of any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of the property exceeds the applicable limits provided in Table 2-1.

Table 2-1: Sound Level Limits in Decibels (dBA)

ZONE		APPLICABLE LIMIT ONE-HOUR AVERAGE SOUND LEVEL (DECIBELS)
R-S, R-D, R-R, R-MH, A-70, A-72, S-80, S-81, S-87, S-88, S-90, S-92, R-V, and R-U Use Regulations with a density of less than 11 dwelling units per acre.	7 a.m. to 10 p.m.	50
	10 p.m. to 7 a.m.	45
R-RO, R-C, R-M, C-30, S-86, R-V, R-U and V5. Use Regulations with a density of 11 or more dwelling units per acre.	7 a.m. to 10 p.m.	55
	10 p.m. to 7 a.m.	50
S-94, V4, and all other commercial zones.	7 a.m. to 10 p.m.	60
	10 p.m. to 7 a.m.	55
V1, V2	7 a.m. to 7 p.m.	60
V1, V2	7 p.m. to 10 p.m.	55
V1	10 p.m. to 7 a.m.	55
V2	10 p.m. to 7 a.m.	50
V3	7 a.m. to 10 p.m.	70
	10 p.m. to 7 a.m.	65
M-50, M-52, M-54	Anytime	70
S-82, M-58, and all other industrial zones.	Anytime	75

Source: County of San Diego Noise Ordinance Section 36.404

As stated above in Section 1, the Project and surrounding properties are zoned General Rural (S-92). Section 36.404 of the Noise Ordinance sets a most restrictive operational exterior noise limit for the S-92 and residential noise sensitive land uses of 50 dBA Leq for daytime hours of 7 a.m. to 10 p.m. and 45 dBA Leq during the noise sensitive nighttime hours of 10 p.m. to 7 a.m.

as shown in Table 2-1 above. Most of the Project components will only operate during the daytime hours but a few may operate during nighttime or early morning hours and therefore the most restrictive and conservative approach is to apply the 45 dBA Leq nighttime standard at the property lines.

2.2 Potential Operational Noise Impacts

This section examines the potential stationary noise source impacts associated with the operation of the proposed Borrego 1 Solar Project. Specifically, noise levels from the proposed transformers, inverters, the substation and the transmission lines. Panels would be electrically connected into panel strings using wiring attached to the racking. Panel strings would be electrically connected to each other via underground wiring. Wire depths would be in accordance with local, State, and Federal codes. Gathering lines would connect individual panel strings to one or more inverters/transformers and combiner boxes distributed throughout the facility. Wiring from the panel strings are connected to combiner boxes. The electrical current is then transferred to the inverters, which convert the Direct Current (DC) produced by the PV panels into Alternating Current (AC). A pad-mounted transformer next to the inverter would increase the voltage. The AC would then travel through underground gathering lines to the Project Substation.

The Project proposes the installation of up to 46 small-scale, above ground structures that would be located within the solar panel fields to shade inverter/distributor transformers and switching gear. These structures would be approximately 9 foot by 30 foot in size and 10 feet high at the roof apex. They would be open on the sides and constructed of wood and steel and would be beige or neutral in color. Each of these locations will house a Satcon PowerGate Plus 1 MW Commercial Solar PV Inverters, or equivalent, and one of the smaller transformers necessary to increase the voltage. The transformer and inverter locations will be spread out over the site with one transformer and one inverter grouped next to each other. The Project also proposes a project Substation located at the southeast corner of the site. The proposed inverter / transformer locations and the Substation location for the fixed array configuration can be seen in Figures 2-A and 2-B for the “fixed” and “tracker” configurations, respectively.

The electric power produced by the Project will be feed into the existing system with the incorporation of a new 69 kV Gen-Tie transmission line running from the site to the existing Borrego Valley Road Substation to the south as shown previously in Figure 1-B. The Project does not plan to install any improvements at the existing Borrego Substation that could affect the noise levels. The new transmission lines may increase a phenomenon referred to as the “Corona Affect” along the new transmission route. The operational noise levels from the proposed on site small-scale inverter/transformer buildings along with the Substation equipment and the offsite Corona Affect are analyzed separately below.

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2.2.1 Operational Noise Levels On-site

The Project is proposing two different small-scaled transformers as part of the 46 proposed inverter / transformer sites. The two smaller transformers consist of a 1 MVA from 200V to 12 kV and a 1 MVA from 12V to 34.5 kV. A larger transformer is proposed as part of the Project's site substation and a 20 MVA from 34.5 to 69 kV. The unshielded noise levels for these two small-scaled transformers and the larger transformer are provided below, respectively (*Source: National Electric Manufactures Association (NEMA) Publication No. TR 1-1993*):

1. 1 MVA from 200V to 12 kV - guaranteed 58 dBA @ 5 feet
2. 1 MVA from 12V to 34.5 kV - guaranteed 58 dBA @ 5 feet
3. 20 MVA from 34.5 to 69 kV - guaranteed 71 dBA @ 5 feet

As mention above, there will be up to 46 locations throughout the site with an inverter along with a small transformer. The proposed Satcon PowerGate Plus 1 MW Commercial Solar PV Inverter, or equivalent, has an unshielded noise rating of less than 65 dBA at 5 feet (*Source: Satcon PowerGate Specifications, 2009*). The NEMA test results for transformers and the proposed Satcon inverters manufacturer's specifications are provided as **Attachment A** of this report.

Based upon the Project site layout and the adjacent property zoning two potential impacts may occur. The first potential impact is located along the western property line where the transformer/inverter locations are 60 feet from the property line. The second potential impact is located along the southern and eastern property lines where the site Substation and the transformer/inverter locations could combine to create a cumulative impact. All other proposed pieces of equipment on the site are located farther from the property line and no impacts are anticipated. The two worst case scenarios were analyzed separately below to determine if impacts would occur and if additional analysis of more pieces of equipment is warranted and if any mitigation measures will be required.

Transformer and Inverter Noise Levels

The worst case property line noise levels will occur where a transformer/inverter location is 186 feet from the western property in the fixed array configuration which is zoned S-92 and has a nighttime property line standard of 45 dBA. Under the tracker array configuration the transformer/inverters are located over 400 feet from the nearest property line. The location and relationship to the western property line for the fixed array configuration is shown in Figure 2-C below. The two noise levels of 58 dBA for the transformer and 65 dBA for the inverter were combined and propagated out to the western property line without any shielding. The results of the propagated noise levels are shown in Table 2-2.

Figure 2-C: Worst Case Property Line Orientation (Western PL)

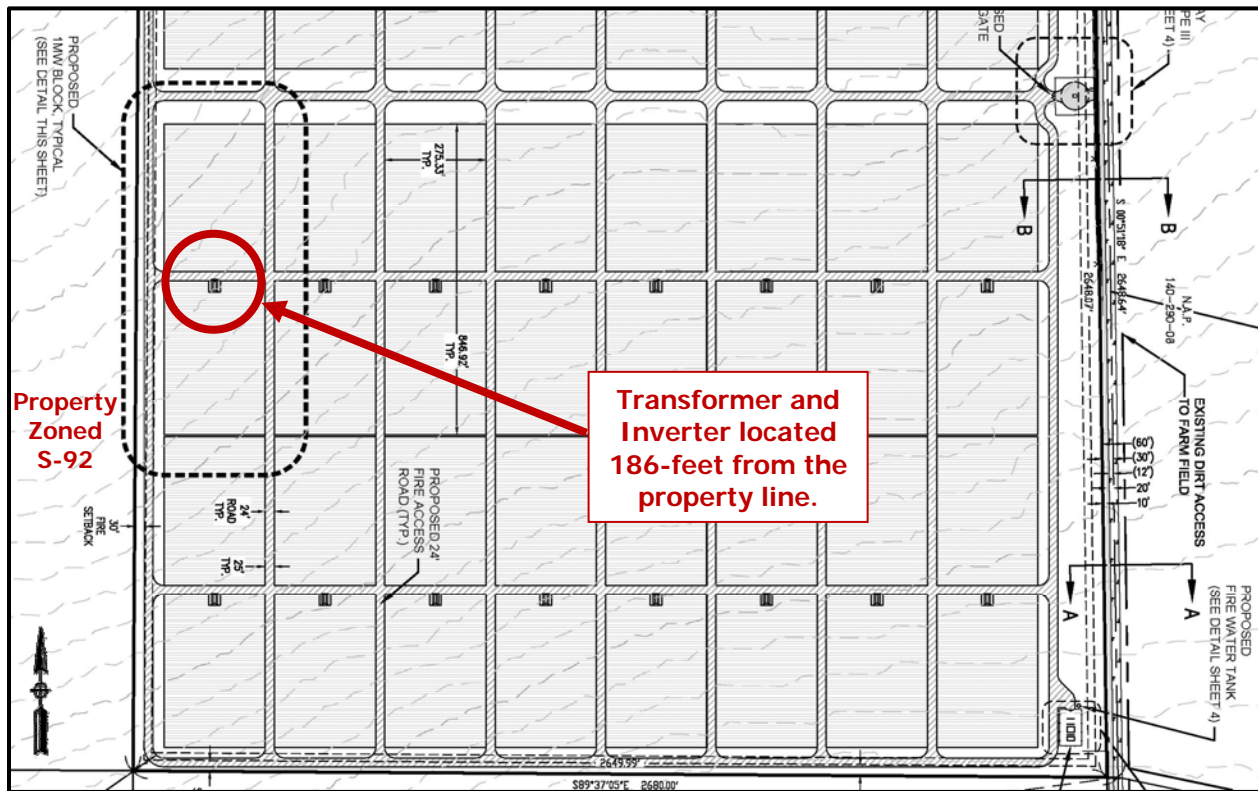


Table 2-2: Transformer/Inverter Noise Levels – Nearest Property Line

Source	Noise Level @ 5-Feet (dBA) ¹	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Transformer	58.0	186	-31.4	26.6
Inverter	65.0	186	-31.4	33.6
Cumulative Noise Level @ Property Line (dBA)				34.4
¹ Noise data provided as an attachment to this report				

The combined noise level at the nearest property line was projected to be 34.4 dBA Leq and no impacts are anticipated. In fact, at a distance of 55 feet or more the transformers/inverters, unshielded, will comply with the most restrictive property line standards and no future analysis is needed for the transform/inverters. The transformers/inverters will be covered by shade structures which will further reduce the noise levels. Additionally, the transformers/inverters are located 280 feet or more from each other and will not cumulatively raise the noise levels at the nearest property line due to distance.

Substation Noise Levels

The worst case property line noise levels will occur near the southwest corner of the Project site where the site Substation is proposed. In the fixed array and track array configurations the Substation is located 105 feet from the southern property line and 145 feet from the eastern property line. A single small-scaled transformer/inverter location is between 370 feet to 580 feet from the nearest property line depending on the configuration. The location and relationships of the Substation, nearest transformer/inverter, and the southern and eastern property lines for the fixed and tracker array configurations are provided in Figure 2-D and 2-E, respectively.

Figure 2-D: Property Line Orientation (Fixed Array)

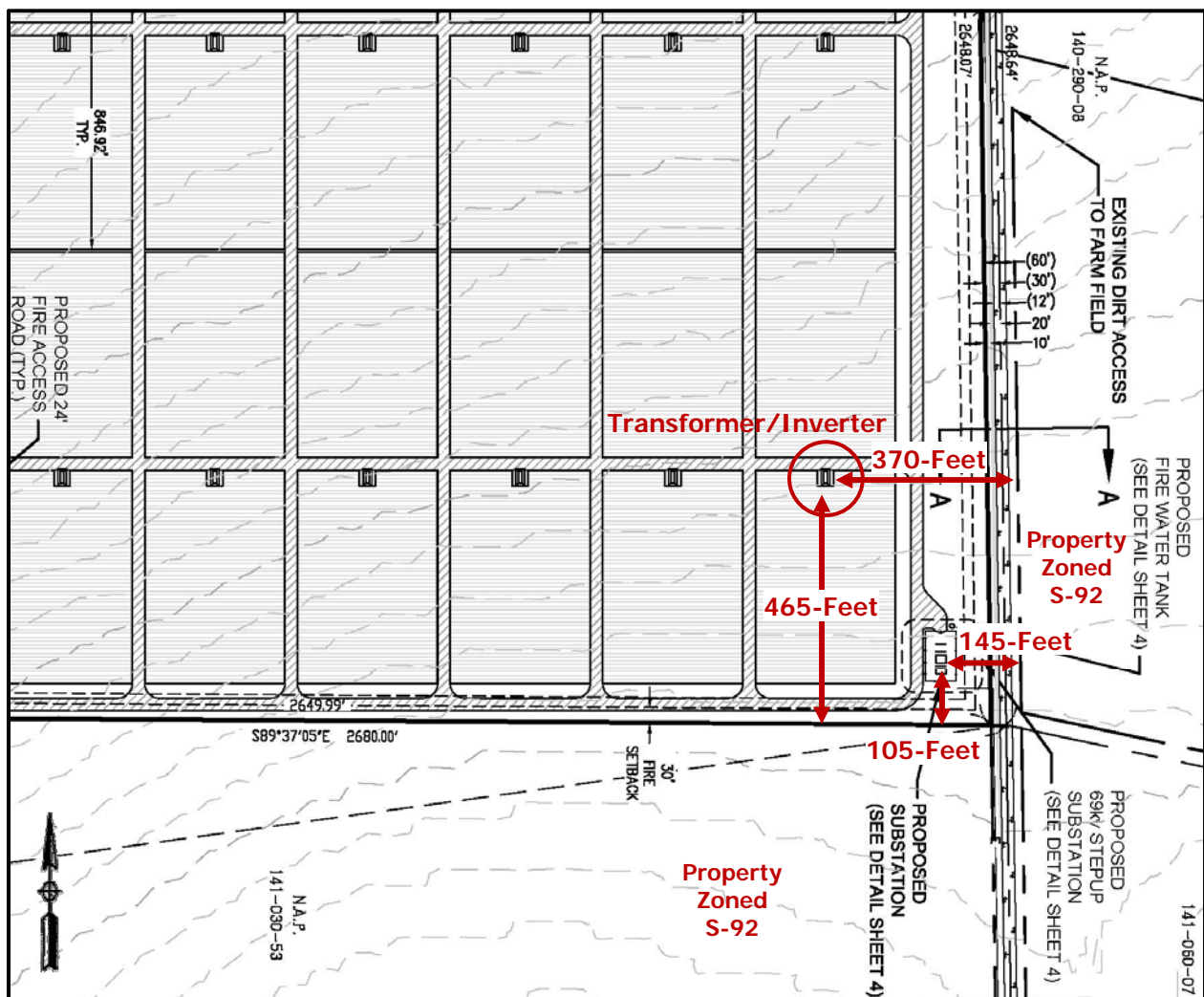
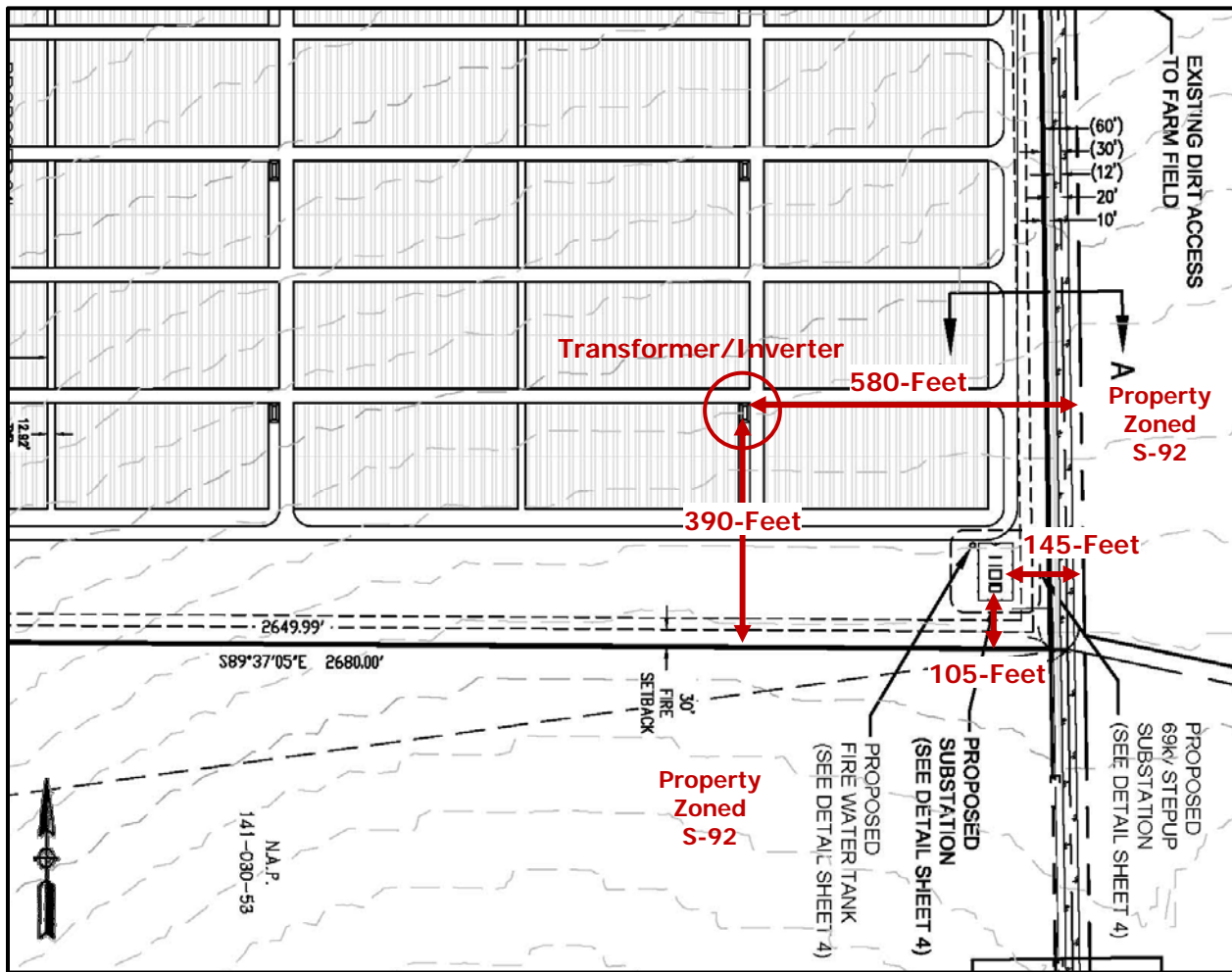


Figure 2-E: Property Line Orientation (Tracker Array)



The Substation has the highest noise level and is closest to the property lines. As can be seen in both Figures 2-D and 2-E, the worst case property line noise levels will occur at the southern property line if due to the proximity of the Project Substation. To determine the cumulative noise levels at the property line, the noise levels of 58 dBA from the transformer, 65 dBA from the inverter and 71 dBA for the larger transformer at the Substation were combined and propagated out to the nearest property line (southern) without any shielding from the proposed buildings. The results of the propagated noise levels for both the fixed and tracker array configurations are provided in Tables 2-3 and 2-4 below.

Table 2-3: Substation Property Line Noise Levels (Fixed Array)

Source	Noise Level @ 5-Feet (dBA) ¹	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Transformer	58.0	465	-39.4	18.6
Inverter	65.0	465	-39.4	25.6
Substation	71.0	105	-26.4	44.6
Cumulative Noise Level @ Property Line (dBA)				44.6
¹ Noise data provided as an attachment to this report				

Table 2-4: Substation Property Line Noise Levels (Tracker Array)

Source	Noise Level @ 5-Feet (dBA) ¹	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA)
Transformer	58.0	390	-37.8	20.2
Inverter	65.0	390	-37.8	27.2
Substation	71.0	105	-26.4	44.6
Cumulative Noise Level @ Property Line (dBA)				44.6
¹ Noise data provided as an attachment to this report				

The combined noise levels at the southern property line were projected to be 44.6 dBA Leq and no impacts are anticipated from the Substation located in the southeast corner of the Project site. Therefore at a distance of 105 feet or more from the Substation in combination with the pad mounted transformer/inverters will comply with the most restrictive property line standards without shielding and no future analysis is needed. The transformers/inverters will be housed inside a concrete or steel building which will further reduce the noise levels. Additionally, all remaining small-scale transformers/inverters are located 280 feet or more from the Substation and will not cumulatively raise the noise levels at the nearest property line due to distance.

2.2.2 Corona Affect Noise Levels

The Corona Affect (Corona) is a phenomenon associated with the electrical ionization of the air that occurs near the surface of the energized conductor and suspension hardware due to very high electric field strength. This is audible power line noise that is generated from electric corona discharge, which is usually experienced as a random crackling or hissing sound. The amount of corona produced by a transmission line is a function of the voltage of the line, the diameter of the conductors, the locations of the conductors in relation to each other, the

elevation of the line above sea level, the condition of the conductors and hardware, and the local weather conditions.

Corona increases at higher elevations where the density of the atmosphere is less than at sea level. Audible noise will vary with elevation with the relationship of $X/300$ where X is the elevation of the transmission line above sea level measured in meters (EPRI 2005). Audible noise at 600 meters (~2,000 feet) in elevation will be twice the audible noise at 300 meters, all other things being equal. Typically for transmission lines of 138 kV and less, the maximum corona noise during wet weather conditions is usually less than 40 dBA at the edge of the ROW (*Source: Miguel-Mission 230 kV #2 Project, Aspen Environmental Group, 2004*). Corona typically becomes a design concern for transmission lines at 345 kV and above and is less noticeable from lines like those proposed for the Project that are operated at lower voltages.

The electric field gradient is greatest at the surface of the conductor. Large-diameter conductors have lower electric field gradients at the conductor surface and, hence, lower corona than smaller conductors. The conductors chosen for the Gen-Tie Lines were selected to have larger diameters and thus a reduced potential to create audible noise. Irregularities, such as nicks and scrapes on the conductor surface, concentrate the electric field at these locations and increase the electric field gradient and thus the resulting corona. Similarly, dust or insects on the conductor surface can cause irregularities and are a source for corona along with moisture from fog or raindrops. Corona noise is primarily audible during wet weather conditions such as fog and rain. Heavy rain will typically generate a noise level from the falling rain drops hitting the ground that will be greater than the noise generated by corona and thus mask the audible noise from the transmission line.

Corona produced by a transmission line can be reduced by changing the design of the transmission line and through the selection of the conductors and hardware used for the construction of the line. For instance the use of conductor hangers that have rounded rather than sharp edges and no protruding sharp edges will help reduce corona.

To determine the corona of the proposed Gen-Tie transmissions line, noise measurements were taken along an existing 69 kV transmission lines in the Borrego Springs area. The short-term measurements were conducted by Ldn Consulting December 4, 2009. The noise measurements were conducted along an SDGE easement south of Borrego Springs as depicted previously in Figure 1-E. Due to ambient noise sources consisting of airplanes, automobiles and birds only one-minute measurements could be taken without the results being affected by factors other than the existing 69 kV transmission lines. During the noise measurements, the crackling or hissing of the transmission lines was slightly audible and the weather conditions were dry and calm. The results of those short-term measurements are provided in Table 2-5 below.

Table 2-5: Measured Corona Noise Levels along 69 kV Lines

Location	Time	One Hour Noise Levels (dBA)					
		Leq	Lmin	Lmax	L10	L50	L90
69 kV Transmission Lines – Borrego Springs	9:35–9:36 a.m.	17.6	16.7	22.7	18.7	17.0	16.8
69 kV Transmission Lines – Borrego Springs	9:37–9:38 a.m.	18.3	17.4	27.2	19.3	18.1	17.7
Source: Ldn Consulting, Inc. December 4, 2009							

As can be seen in Table 2-5, during the dry conditions the noise levels from the Corona were very low, below 20 dBA. Typically during moist or wet conditions the Corona noise can double. This would result in a noise level of 35-37 dBA which is consistent with previous studies and modeling efforts conducted by the Electric Power Research Institute (EPRI) and CH2M Hill for the Cross Valley Transmission Line Project conducted for Southern California Edison 2008.

2.3 Conclusions

Based on the empirical data, the manufactures specifications and the distances to the property lines the unshielded cumulative noise levels from the proposed transformers/inverters and the proposed Substation were found to be below the most restrictive nighttime property line standard of 45 dBA at the S-92 zoning. No impacts are anticipated and no mitigation is required.

The measured Corona Affect noise levels were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission lines associated with the Project.

3.0 CONSTRUCTION ACTIVITIES

3.1 Guidelines for the Determination of Significance

Construction Noise: Noise generated by construction activities related to the Project will be considered a significant impact if the noise levels exceed the standards listed in San Diego County Code Section 36.410, Construction Equipment.

Section 36.410 states:

Except for emergency work,

- a) It shall be unlawful for any person to operate construction equipment between the hours of 7 p.m. of any day and 7 a.m. of the following day.
- b) It shall also be unlawful for any person to operate construction equipment on Sundays, and days appointed by the President, Governor, or the Board of Supervisors for a public fast, Thanksgiving, or holiday, but a person may operate construction equipment on the above-specified days between the hours of 10 a.m. and 5 p.m. at his residence or for the purpose of constructing a residence for himself, provided that the average sound level does not exceed 75 decibels during the period of operation and that the operation of construction equipment is not carried out for profit or livelihood.
- c) It shall also be unlawful to operate any construction equipment so as to cause at or beyond the property line of any property upon which a legal dwelling unit is located an average sound level greater than 75 decibels between the hours of 7 a.m. and 7 p.m.

For temporary activities, the County considers the 75 decibel (A) average to be based on a period of eight hours.

3.2 Potential Construction Noise Impacts

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders and scrapers can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts and little or no grading will be necessary for this project. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by

heavy construction equipment at a distance of 50 feet can range from 60 dBA for a small tractor up to 100 dBA for rock breakers. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 87 dBA measured at 50 feet from the noise source would be reduced to 81 dBA at 100 feet from the source and be further reduced to 75 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers. To determine the worst-case noise levels for the grading operations no topographic attenuation, duty-cycle reductions or barrier reductions were utilized.

According to the project applicant, the project site will be grubbed to remove vegetation and compacted in one phase followed by the installation of the PV panels in one or two phases. The project construction period for the 26 MW first phase is expected to be 4-6 months and includes all site preparation, installation of the PV panels and all utilities (i.e., Gen-Tie lines). If a second phase is constructed and if the fixed-tilt configuration is used, the construction timeframe for the second phase would be shorter because of its smaller size and because all site infrastructure will be in place. The grading and subsequent installation of the PV panels is discussed separately below.

The clearing operation will utilize a total of up to three dozers, five graders, four loaders/backhoes and four water trucks. The noise levels utilized in this analysis based upon the anticipated list of equipment are shown in Table 3-1. Most of the construction activities will consist of clearing and grubbing the site for the preparation of the PV panels. The equipment is anticipated to be spread out over the entire site with some equipment potentially operating at or near the property line while the rest of the equipment may be located over 1,000 feet from the same property line. This would result in an acoustical center for the grading operation at approximately 500 feet from the nearest property line.

As can be seen in Table 3-1, if all the equipment was operating in the same location, which is not physically possible, at a distance as close as 165 feet from the nearest property line the point source noise attenuation from construction activities is -10.4 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 74.9 dBA at the property line. Given this and the spatial separation of the equipment, the noise levels will comply with the County of San Diego's 75 dBA standard at all Project property lines.

Table 3-1: Construction Grading Noise Levels

Construction Equipment	Quantity	Duty Cycle (Hours/Day)	Source Level @ 50-Feet (dBA)	Cumulative Noise Level @ 50-Feet (dBA Leq-8h)
Grader	5	8	74	81.0
Water Truck	4	8	70	76.0
Dozer	3	8	75	79.8
Loader	4	8	73	79.0
Cumulative Levels @ 50 Feet (dBA)				85.3
Distance To Property Line				165
Noise Reduction Due To Distance				-10.4
NEAREST PROPERTY LINE NOISE LEVEL				74.9

The installation of the PV panels will utilize a total of two small pile drivers to install the panel stands, two mobile cranes to move the PV panel in position and two pneumatic tools to secure the panels to the stands. The noise levels utilized in this analysis based upon the anticipated list of equipment are shown in Table 3-2. Based upon normal installation procedures the equipment is anticipated to be spread out over the entire site with pile driving occurring first and then the installation of the PV panels with a crane and pneumatic tool. Some equipment may be operating at a distance of 70-120 feet from the property line while the rest of the equipment may be located over 500 feet from the other equipment and same property line. This would result in an acoustical center from the installation operations of at least 300 feet to the nearest property line around the perimeter of the site. The distance to the property lines would increase as the interior panels are installed and the noise levels would decrease due to distance.

Table 3-2: PV Panel Installation Noise Levels

Construction Equipment	Quantity	Duty Cycle (Hours/Day)	Source Level @ 50-Feet (dBA)	Cumulative Noise Level @ 50-Feet (dBA Leq-8h)
Pneumatic Tool	2	8	82	85.0
Mobile Crane	2	8	78	81.0
Pile Driver	2	8	84	87.0
Cumulative Levels @ 50 Feet (dBA)				89.8
Distance To Property Line				275
Noise Reduction Due To Distance				-14.8
NEAREST PROPERTY LINE NOISE LEVEL				74.9

As can be seen in Table 3-2, if all the equipment was operating in the same location, which is not physically possible, at a distance as close as 275 feet from the nearest property line the point source noise attenuation from construction activities is -14.8 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 74.9 dBA at the property line. Given this and the spatial separation of the equipment, the noise levels will comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having an occupied structure. "Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 decibels for an eight-hour period, between 7 a.m. and 7 p.m., when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is being received." Some of the properties adjacent the Project site do not have a legal dwelling unit and are therefore exempt from Section 36.409.

3.2 Construction Conclusions

At a distance as close as 165 feet the point source noise attenuation from the grading activities and the nearest property line is -10.4 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 74.9 dBA at the property line. During the installation of the PV panels at a distance of 275 feet would result in a noise level of 74.9 dBA. The installation equipment is anticipated to average more than 300 feet from the nearest property line. Given this and the spatial separation of the equipment over the large site area, the noise levels of the grading and PV panel installation are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having a legal dwelling unit. Some of the properties adjacent the Project site do not have a legal dwelling unit and are therefore exempt from Section 36.409. Therefore no impacts are anticipated from the grading or PV panel installation operations at any property line and no mitigation or additional analysis is warranted.

4.0 SUMMARY OF PROJECT IMPACTS, MITIGATION & CONCLUSIONS

- Operational Noise Analysis

Based on the empirical data, the manufactures specifications and the distances to the property lines the unshielded cumulative noise levels from the proposed transformers/inverters and the proposed Substation were found to be below the most restrictive nighttime property line standard of 45 dBA. No impacts are anticipated and no mitigation is required.

The measured Corona Affect noise levels were found to be below the County of San Diego's most restrictive nighttime standard of 45 dBA. This was also consistent with previously measured and modeled noise levels on transmission line projects throughout California. No impacts from the Corona Affect are anticipated from the new transmission line associated with the proposed Project and no mitigation is required.

- Construction Noise Analysis

At a distance as close as 165 feet the point source noise attenuation from the grading activities and the nearest property line is -10.4 dBA. This would result in an anticipated worst case eight-hour average combined noise level of 74.9 dBA at the property line. During the installation of the PV panels at a distance of 275 feet would result in a noise level of 74.9 dBA. The installation equipment is anticipated to average more than 300 feet from the nearest property line. Given this and the spatial separation of the equipment over the large site area, the noise levels of the grading and PV panel installation are anticipated to comply with the County of San Diego's 75 dBA standard at all Project property lines.

Additionally, the County Noise Ordinance Section 36.409 (c), states that the 75 dBA threshold pertains to a property having a legal dwelling unit. Some of the properties adjacent the Project site do not have a legal dwelling unit are therefore are exempt from Section 36.409. Therefore no impacts are anticipated from the grading or PV panel installation operations at any property line and no mitigation or additional analysis is warranted.

5.0 CERTIFICATIONS

The contents of this report represent an accurate depiction of the existing and future acoustical environment and impacts within the proposed Borrego 1 Solar Project development. The report was prepared by Jeremy Loudon; a County approved CEQA Consultant for Acoustics.

DRAFT

Jeremy Loudon
Principal
Ldn Consulting, Inc.

Date January 14, 2011

ATTACHMENT A

MANUFACTURES SPECIFICATIONS AND NOISE DATA
(Transformers and Inverters)

NEMA Standards Publication No. TR 1-1993 (R2000)

Transformers, Regulators and Reactors

Published by:

National Electrical Manufacturers Association
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Rosslyn, VA 22209

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FOREWORD

The standards appearing in this publication have been developed by the Transformer Section and have been approved for publication by the National Electrical Manufacturers Association. They are used by the electrical industry to promote production economies and to assist users in the proper selection of transformers.

The Transformer Section is working actively with the American National Standards Committee, C57, on Transformers, Regulators and Reactors, in the development, correlation and maintenance of national standards for transformers. This Committee operates under the procedures of the American National Standards Institute (ANSI).

It is the policy of the NEMA Transformer Section to remove material from the NEMA Standards Publication as it is adopted and published in the American National Standard C57 series. The NEMA Standards Publication for Transformers, Regulators and Reactors references these and other American National Standards applying to transformers, and is intended to supplement, without duplication, the American National Standards.

The NEMA Standards Publication for Transformers, Regulators and Reactors contains provision for the following:

- a. American National Standards adopted by reference and applicable exceptions approved by NEMA, if any.
- b. NEMA Official Standards Proposals. These are official drafts of proposed standards developed within NEMA or in cooperation with other interested organizations, for consideration by ANSI. They have a maximum life of five years, during which time they may be approved as American National Standards or adopted as NEMA Standards, or rescinded.
- c. Manufacturing Standards. These are NEMA Standards which are primarily of interest to the manufacturers of transformers and which are not yet included in an American National Standard.
- d. Standards Which Are Controversial. These are NEMA Standards, on which there is a difference of opinion within Committee C57. The NEMA version will be included in the NEMA Standards Publication until such time as the differences between ANSI and NEMA are resolved.

NEMA Standards Publications are subject to periodic review and take into consideration user input. They are being revised constantly to meet changing economic conditions and technical progress. Users should secure latest editions. Proposed or recommended revisions should be submitted to:

Vice President, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037-1526

SCOPE

This publication provides a list of all ANSI C57 Standards that have been approved by NEMA. In addition it includes certain NEMA Standard test methods, test codes, properties, etc., of liquid-immersed transformers, regulators, and reactors that are not American National Standards.

PART 0 GENERAL

The following American National Standards have been approved as NEMA Standards and should be inserted in this Part 0:

ANSI/IEEE C57.12.00-1988	<i>General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers</i>
ANSI/IEEE C57.12.01-1989	<i>General Requirements for Dry Type Power and Distribution Transformers</i>
ANSI C57.12.10-1988	<i>Requirements for Transformers 230,000 volts and below, 833/958-8333/10,417 kVA single-phase 750/862-60,000/80,000/100,000 kVA three phase, including supplements</i>
ANSI C57.12.70-1993	<i>Terminal Markings and Connections for Distribution and Power Transformers</i>
ANSI/IEEE C57.12.90-1993	<i>Test Code for Liquid-immersed Distribution, Power & Regulating Transformers and Guide for Short-Circuit Testing of Distribution & Power Transformers</i>
ANSI/IEEE C57.19.00-1992	<i>General Requirements and Test Procedure for Outdoor Apparatus Bushings</i>
ANSI/IEEE C57.19.01-1992	<i>Standard Performance Characteristics & Dimensions for Outdoor Apparatus Bushings</i>
ANSI/IEEE C57.92-1992	<i>Guide for Loading Mineral-oil-immersed Power Transformers up to and including 100 MVA with 55C or 65C Average Winding Rise</i>

The NEMA Standards TR 1-0.01 through TR 1-0.09 on the following pages (see Part 0 Pages 1-9) also apply generally to transformers.

0.01 PREFERRED VOLTAGE RATINGS

Preferred system voltages and corresponding transformer voltage ratings are given in the American National Standard for Electric Power Systems and Equipment--Voltage Ratings (60 Hz), C84.1-1989. It is recommended that these ratings be used as a guide in the purchase and operation of transformers.

0.02 FORCED-AIR (FA) AND FORCED-OIL (FOA) RATINGS

Under the conditions of par. 5.11 of American National Standard ANSI/IEEE C57.12.00-1988, the relationship between self-cooled ratings and forced-air-cooled or forced-oil-cooled ratings shall be in accordance with Table 0-1.

**Table 0-1
FORCED-AIR AND FORCED-OIL RATINGS RELATIONSHIPS**

Class	Self-cooled Ratings* (kVA)		Percent of Self-Cooled Ratings With Auxiliary Cooling	
	Single Phase	Three Phase	First Stage	Second Stage
OA/FA	501-2499	501-2499	115	--
OA/FA	2500-9999	2500-11999	125	--
OA/FA	10000 and above	12000 and above	133-1/3	--
OA/FA/FA	10000 and above	12000 and above	133-1/3	166-2/3
OA/FA/FOA	10000 and above	12000 and above	133-1/3	166-2/3
OA/FOA/FOA	10000 and above	12000 and above	133-1/3	166-2/3

*In the case of multi-winding transformers or autotransformers, the ratings given are the equivalent two-winding ratings.

PERFORMANCE

0.03 RADIO INFLUENCE VOLTAGE LEVELS

The following values apply to liquid-filled transformers. They do not apply to load tap changing during switching or to operation of auxiliary relays and control switches.

0.03.1 Distribution Transformers

Radio influence voltage levels for distribution transformers, for systems rated 69 kV and less, shall not exceed 100 microvolts when measured in accordance with Section 7.01. The test voltage shall be the line-to-neutral voltage corresponding to 110 percent excitation of the transformer. This will be the coil voltage for wye connections and 1/3 times the coil voltage for delta connections.

0.04 POWER FACTOR OF INSULATION OF OIL-IMMERSED TRANSFORMERS

While the real significance which can be attached to the power factor of oil-immersed transformers is still a matter of opinion, experience has shown that power factor is helpful in assessing the probable conditions of the insulation when good judgement is used.

The proper interpretation of power factor of oil-immersed transformers is being given careful attention by manufacturers in connection with the problems of (1) selecting insulating materials, (2) sealing, and (3) processing the transformers. However, it is the comparative values which are guides for the successful solution for these problems rather than an absolute value of power factor.

The generally accepted factory tests for proving the insulation level are the prescribed low-frequency tests and impulse tests given in the American National Standard C57.12.90-1993.

When required, a factory power-factor test can be made, and this measurement will be of value for comparison with field power-factor measurements to assess the

probable condition of the insulation. It is not feasible to establish standard power-factor values for oil-immersed transformers because:

- a. Experience has definitely proved that little or no relation exists between power factor and the ability of the transformer to withstand the prescribed dielectric tests.
- b. Experience has definitely proved that the variation in power factor with temperature is substantial and erratic so that no single correction curve will fit all cases.

When a factory power-factor measurement of a transformer is required, the measurement should be made with the insulation at room temperature, preferably at or close to 20°C.

0.05 AUDIBLE SOUND LEVELS

Transformers shall be so designed that the average sound level will not exceed the values given in Tables 0-2 through 0-4 when measured at the factory in accordance with the conditions outlined in ANSI/IEEE C57.12.90-1993.

The guaranteed sound levels should continue to be per Tables 0-2 through 0-4 until such time as enough data on measured noise power levels becomes available.

Sound pressure levels are established and published in this document. Sound power may be calculated from sound pressure, using the method described in C57.12.90-1993.

Rectifier, railway, furnace, grounding, mobile and mobile unit substation transformers are not covered by the tables. The tables do not apply during the time that power switches are operating in load-tap-changing transformers and in transformers with integral power switches.

Table 0-3
AUDIBLE SOUND LEVELS FOR LIQUID-IMMERSED
DISTRIBUTION TRANSFORMERS AND NETWORK TRANSFORMERS

Equivalent Two-winding kVA	Average Sound Level, Decibels
0-50	48
51-100	51
101-300	55
301-500	56
750	57
Small Transformer 1000	58
1500	60
2000	61
2500	62

Table 0-4
AUDIBLE SOUND LEVELS FOR DRY-TYPE TRANSFORMERS 15000-VOLT
NOMINAL SYSTEM VOLTAGE AND BELOW

Equivalent Two-Winding kVA	Average Sound Level, Decibels		Equivalent Two-winding kVA	Average Sound Level, Decibels
	Self-cooled Ventilated*	Self-cooled Sealed*		Ventilated Forced Air Cooled **,†
0-50	50	50
51-150	55	55
151-300	58	57	3-300	67
301-500	60	59	301-500	67
501-700	62	61	501-833	67
701-1000	64	63	834-1167	67
1001-1500	65	64	1168-1667	68
1501-2000	66	65	1668-2000	69
Large Transformer 2001-3000	68	66	2001-3333	71
3001-4000	70	68	3334-5000	73
4001-5000	71	69	5001-6667	74
5001-6000	72	70	6668-8333	75
6001-7500	73	71	8334-10000	76

* Class AA rating

**Does not apply to sealed-type transformers

†Class FA and AFA ratings

Part 1

POWER TRANSFORMERS

The American National Standard C57.12.10-1988 has been approved as a NEMA Standard for power transformers and should be inserted in this Part 1.

The ANSI/IEEE Standard C57.92-1992, has been approved by NEMA and should be inserted in this Part 1.

The following other parts of this NEMA Publication No. TR 1 shall also apply:

- a. Part 1 General
- b. Part 6 Terminology
- c. Part 7 Test Code
- d. Part 12 Underground-Type Three-Phase Distribution Transformer

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Boosts overall PV plant kilowatt yield

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PowerGate® Plus 1 MW Commercial Solar PV Inverter



PowerGate Plus 1 MW Specifications

UL/CSA

CE

Input Parameters

Maximum Array Input Voltage	900V DC (CE)	•	•
Input Voltage Range (MPPT; Full Power)	420–850V DC	•	•
Maximum Input Current	2,397A DC	•	•

Output Parameters

Nominal Output Voltage to Transformer	265V AC	•	•
Output Frequency Range	59.5–60.5 Hz	•	
	49.5–50.5 Hz		•
AC Voltage Range Set Points	-12%/+10%	•	•
Nominal Output Frequency	60 Hz	•	
	50 Hz		•
Number of Phases	3	•	•
Maximum Output Current per Phase	2,178A	•	•
Maximum Overcurrent Protection per Phase	2,614A	•	•
CEC-Weighted Efficiency	97%	•	•
Maximum Continuous Output Power	1000 kW (1000 kVA)	•	•
Power Factor at Full Load	>0.99	•	•
Harmonic Distortion	<3% THD	•	•

Temperature

Operating Ambient Temperature Range (Full Power)	-20° C to +50° C	•	•
Storage Temperature Range	-30° C to +70° C	•	•
Cooling	Forced Air	•	•

Noise

Noise Level	<65 dB(A)	•	•
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• Standard • Optional



PowerGate Plus 1 MW

UL/CSA 265V AC Output

CE 265V AC Output

External transformer required.

Streamlined Design

With all components encased in a single, space-saving enclosure, PowerGate Plus PV inverters are easy to install, operate, and maintain.

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Uses medium voltage output to accommodate long-distance power feeds to designated loads or substations

PowerGate Plus 1 MW Specifications		UL/CSA	CE
Combiner			
Number of Inputs and Fuse Rating	40 (160A DC) (Opt.)	○	○
	60 (100A DC) (Opt.)	○	○
Transformer			
External Transformer		○	○
Inverter and Integrated External Transformer Cabinets			
Enclosure Rating (Outdoor)	NEMA 3R, IP44	●	●
Enclosure Finish (16-Gauge, Powder-Coated Steel)	RAL-7032	●	●
Base and Door Finish (14-Gauge, Powder-Coated Steel)	RAL-7032	●	●
Cabinet Dimensions (Height x Width x Depth)	Inverter	107" x 148" x 84" (272 cm x 376 cm x 213 cm)	
Cabinet Weight	Inverter	12,000 lbs.	5,443 kg
Testing and Certification			
UL1741, CSA 107.1-01, IEEE 1547, IEEE C62.41.2		●	
CE Certification			●
Zone 4 Seismic Rating		●	●
Warranty			
Five Years		●	●
Extended Warranty (10, 15, or 20 years) (Optional)		○	○
Extended Service Agreement (Optional)		○	○
Intelligent Monitoring			
Satcon PV View® Plus (Optional)		○	○
Satcon PV Zone (Optional)		○	○
Third-Party Compatibility		○	○

- Standard
- Optional

Note: Specifications are subject to change.

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